An impedance matching circuit M for increasing the impedance in the low-frequency attenuation band A thereof is connected between the nodes a and b and the filter F2. The impedance matching circuit M includes an inductor L, which is a high-impedance element for rotating the phase of signal. The inductor L has an inductance of, for example, 6 nH. The inductor L can be formed with, for example, a metallic strip line made of, for example, gold, tungsten, or copper, and formed on a glass-epoxy or ceramic substrate. The strip line formed on the glass-epoxy substrate has a width of 0.5 mm and a length of 11 mm, and the strip line formed on the ceramic substrate has a width of 0.2 mm and a length of 6 mm.

As shown in FIG. 75, the impedance matching circuit M provided for the filter F2 rotates the phase in the direction indicated by the arrow, and the impedance of the filter F2 in the low-frequency attenuation band A can be increased.

FIG. 76 shows a wave filter according to an eighteenth embodiment of the present invention. In FIG. 76, parts that are the same as parts shown in the previously described figures are given the same reference symbols. The wave filter shown in FIG. 76 can be obtained by connecting a capacitor C, which corrects the quantity of phase rotation of the inductor L, in series between the inductor L and the series-arm resonator Rso. There is a possibility that a suitable impedance matching may be not obtained by means of only inductor L. As shown in a Smith's chart shown in FIG. 77, the phase is rotated in the direction indicated by the arrow shown in FIG. 77 first, and is rotated by means of the inductor L second.

FIG. 78 shows a wave filter according to a nineteenth embodiment of the present invention. The filter F1 comprises the series-arm SAW resonator Rso and the parallel-arm SAW resonator Rp, which are connected so that the series-arm resonator is located at the first stage of the filter F1. The parallel-arm SAW resonator Rpo of the filter F is located at the first stage of the filter F. A line S for use in phase rotation is connected in series to the SAW filter F2. It is possible to increase the impedance of the filter F1 within the high-frequency attenuation band B thereof even by an arrangement such that only the filter F1 has the series-arm resonator of the first stage. In this case, the resonator of the first stage of the filter F2 is the parallel-arm resonator Rpo connected in parallel to the pair of common signal terminals T0, and the low-frequency attenuation band A of the filter F2 (corresponding to the pass band of the filter F1) does not have a high impedance. Hence, according to the present embodiment, the phase rotation line S is connected in series to the filter F2.

As shown in FIG. 79, the direction of phase rotation caused by the line S is opposite to the directions shown in FIGS. 75 and 77. However, as shown in FIG. 80, suitable matching of the filter F2 can be obtained. In this case, the length of the line S formed on the glass-epoxy substrate is approximately 25 mm, and the length of the line S formed on the ceramic substrate is approximately 26 mm.

A variation f the configuration shown in FIG. 78 can be made by providing the inductor L in the same manner as sh wn in FIG. 74. It is als possible to further provide the capacitor C in the same manner as shown in FIG. 76.

The band center frequencies f_1 and f_2 f the sixteenth through nineteenth embodiments of the present inventi n are n t limited to 887 MHz and 932 MHz.

The present invention is not limited to the specifically disclosed embodiments, and variations and modificati ns may be made without departing from the scope of the present invention.

What is claimed is:

1. A band-pass filter having a pair of band-pass filter input terminals and plural pairs of band-pass filter output terminals, comprising:

a pair of SAW filters having respective pass bands and comprising a plurality of one-port SAW resonators connected in a ladder structure, each having at least a first stage located at a side of the pair of band-pass filter input terminals and a series-arm resonator located at the first stage, a pair of input terminals and a pair of output terminals;

the pair of band-pass filter input terminals being commonly connected to the respective pairs of input terminals of the pair of SAW filters;

the plurality of pairs of band-pass filter output terminals being connected to the respective pairs of output terminals of the pair of SAW filters; and

an inductance element located between at least one of the SAW filters located at the first stage and the pair of band-pass filter input terminals and directly connected between the respective pair of input terminals of the at least one of the SAW filters and thereby in parallel to said at least one of the SAW filters.

2. A SAW filter comprising:

a plurality of first SAW resonators, each having a pair of terminals and a predetermined resonance frequency (f_{rp}), said first SAW resonators being connected in respective, parallel arms of the SAW filter;

a plurality of second SAW resonators, each having a pair of terminals and a predetermined resonance frequency (f_{rr}) approximately equal to an antiresonance frequency (f_{ap}) of each of the first SAW resonators, said second SAW resonators being provided in series arms of the SAW filter; and

inductance elements respectively connected in series with the first SAW resonators in the parallel arms and formed of wires.

3. The SAW filter as claimed in claim 2, further comprising:

a package accommodating the first and second resonators and the inductance elements; and

lead terminals extending from interiorly of the package to exteriorly thereof, said wires of the inductance elements being bonded to said lead terminals.

4. A band-pass filter having a predetermined pass-band characteristic and comprising:

a plurality of SAW resonators connected in a ladder formation, said plurality of resonators being connected in respective said serial ~~arms and~~ parallel arms; and

bonding inductance elements, said parallel arms of said ladder formation being connected to ground via respective said bonding inductance elements.

5. The band-pass filter as claimed in claim 4, wherein said bonding inductance elements comprise wires.

6. A band-pass filter having a pair of band-pass filter input terminals and plural pairs of band-pass filter output terminals, comprising:

a pair of SAW filters having respective, different pass bands and each SAW filter having a pair of SAW filter input terminals and a pair of SAW filter output terminals and comprising a plurality of one-port SAW resonators connected in a ladder structure between the input and output terminals and including at least a first stage having a series-arm SAW resonator connected to one of the pair of input terminals;

a pair of SAW filters having respective pass bands and comprising a plurality of one-port SAW resonators connected in a ladder structure, each having at least a first stage located at a side of the pair of band-pass filter input terminals and a series-arm resonator located at the first stage, a pair of input terminals and a pair of output terminals;

the pair of band-pass filter input terminals being commonly connected to the respective pairs of input terminals of the pair of SAW filters;

the plurality of pairs of band-pass filter output terminals being connected to the respective pairs of output terminals of the pair of SAW filters.

7. A band-pass filter having a predetermined pass-band characteristic and comprising:

a plurality of SAW resonators connected in a ladder configuration of respective serial arms and parallel arms, said plurality of SAW resonators being connected in respective said serial arms and parallel arms; and

bonding inductance elements respectively connecting said parallel arms of said ladder configuration to ground.

* * * * *

--8. A SAW filter comprising:

a plurality of first SAW resonators, each having a pair of terminals and a predetermined resonance frequency, said first SAW resonators being connected in respective, parallel arms of said SAW filter; and

a plurality of second SAW resonators, each having a pair of terminals and a predetermined resonance frequency approximately equal to an antiresonance frequency of each of said first SAW resonators, said second SAW resonators being provided in series arms of said SAW filter;

each of said first SAW resonators including an exciting interdigital electrode and first and second reflectors, respectively located on opposite sides of said exciting interdigital electrode, said exciting interdigital electrode and said first and second reflectors being made of aluminum, or of an aluminum alloy containing a small percentage of metal other than aluminum, by weight, a film thickness of said exciting interdigital electrode and said first and second reflectors ranging from 0.06 to 0.09 times a period of said exciting interdigital electrode.

--9. A SAW filter comprising:

a plurality of first SAW resonators, each having a pair of terminals and a predetermined resonance frequency, said first SAW resonators being connected in respective, parallel arms of said SAW filter; and

a plurality of second SAW resonators, each having a pair of terminals and a predetermined resonance frequency approximately equal to an antiresonance frequency of each of said first SAW resonators, said second SAW resonators being provided in series arms of said

SAW filter;

each of said first SAW resonators including an exciting interdigital electrode and first and second reflectors respectively located on opposite sides of said exciting interdigital electrode, said exciting interdigital electrode and said first and second reflectors being made of gold, or of a gold alloy containing a small percentage of metal other than gold, by weight, a film thickness of said exciting interdigital electrode and said first and second reflectors ranging from 0.0086 to 0.013 times a period of said exciting interdigital electrode.

--**10**. A SAW filter as claimed in claim 8 or 9, wherein each of the series arms of said SAW filter includes two of said second SAW resonators, further comprising an inductance connected in series to each of the two of said second SAW resonators.

--**11**. A SAW filter comprising:

a plurality of first SAW resonators, each having a pair of terminals and a predetermined resonance frequency, said first SAW resonators being connected in respective, parallel arms of said SAW filter;

inductance elements connected in series to respective ones of said first SAW resonators in the parallel arms of said SAW filter;

a plurality of second SAW resonators, each having a pair of terminals and a predetermined resonance frequency approximately equal to an antiresonance frequency of each of said first SAW resonators, said second SAW resonators being provided in series arms of said SAW filter;

a first product of an aperture length and a number of electrode finger pairs of each of said first SAW resonators being larger than a second product of an aperture length and a number of electrode finger pairs of each of said second SAW resonators.

--12. An RF SAW filter having a relative bandwidth equal to or greater than 2%, a suppression factor equal to or larger than 20dB, and an insertion loss less than or equal to 5 dB comprising:

a plurality of first SAW resonators, each having a pair of terminals and a predetermined resonance frequency, said first SAW resonators being connected in respective, parallel arms of said SAW filter;

a plurality of second SAW resonators, each having a pair of terminals and a predetermined resonance frequency approximately equal to an antiresonance frequency of each of said first SAW resonators, said second SAW resonators being provided in series arms of said SAW filter; and

inductance elements respectively connected in series with said first SAW resonators in the parallel arms.

--13. A SAW filter as claimed in claim 12, wherein an aperture length of each of said first SAW resonators is larger than an aperture length of each of said second SAW resonators.

--14. A SAW filter as claimed in claim 12, wherein a number of electrode finger pairs of each of said first SAW resonators is larger than a number of electrode finger pairs of each of

said second SAW resonators.

--**15**. A SAW filter as claimed in claim 2, 4, 7, 11 or 12, wherein said inductance elements have different inductance values.

--**16**. A SAW filter as claimed in claim 2, 4, 7, 8, 9, 11 or 12, wherein said SAW filter is mounted in a ceramic package.

--**17**. A SAW filter as claimed in claim 2, 4, 7, 11 or 12, wherein said inductance elements are provided at a path which is between the parallel arms and ground level on a ceramic package in which said SAW filter is mounted.

--**18**. A SAW filter as claimed in claim 2, 4, 7, 11 or 12, wherein each of said inductance elements includes a bonding wire connected in series to the corresponding one of said first SAW resonators in the parallel arms, the bonding wire being longer than bonding wires for input and output terminals of said SAW filter.

--**19.** A SAW filter comprising:

first SAW resonators provided in parallel arms of said SAW filter, each of said first SAW resonators having a predetermined resonance frequency;

second SAW resonators provided in series arms of said SAW filter, each of said second SAW resonators having a predetermined resonance frequency approximately equal to an antiresonance frequency of each said first SAW resonators; and

inductance elements connected in series with said first SAW resonators in said parallel arms of said SAW filter.

--**20.** A band-pass filter having a predetermined pass-band characteristic, comprising:

SAW resonators connected in a ladder formation in serial arms and parallel arms; and

bonding inductance elements to couple said parallel arms of said ladder formation to a reference potential.

--**21.** A SAW filter comprising:

a first SAW resonator in a parallel arm of said SAW filter and having a predetermined resonance frequency;

a second SAW resonator in a series arm of said SAW filter and having a predetermined resonance frequency approximately equal to an antiresonance frequency of said first SAW resonator; and

an inductance element connected in series with said first SAW resonator, said inductance element functioning to increase the admittance of the parallel arm and decrease the resonance frequency.

add C6

add B4 add D27

add G1